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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/743,979	12/22/2003	Chun-Li Chou	N1085-00258 [TSMC2003-089]	9038
8933	7590	03/25/2005	EXAMINER	
DUANE MORRIS, LLP IP DEPARTMENT ONE LIBERTY PLACE PHILADELPHIA, PA 19103-7396			GODFREY, GEORGE A	
			ART UNIT	PAPER NUMBER
			1763	

DATE MAILED: 03/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/743,979

Applicant(s)

CHOU ET AL.

Examiner

George A. Goudreau

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on (12-22-03' to 6-3-04').
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3, 9, 11-15, and 17-20 is/are rejected.
- 7) ☒ Claim(s) 4-8, 10 and 16 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

George A. Goudreau
GEORGE GOUDREAU
PRIMARY EXAMINER

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1-3, 9, 11-15, and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bergman et. al. (6,273,108).

Bergman et. al. disclose a process for generically stripping a photo resist mask from the surface of semiconductor wafers by rotating the wafers (20) which are supported in a wafer carrier (25) in a solution which is comprised of (O3-DI H2O) at a speed of 300 rpm. The ozonated water is sprayed onto the surface of the wafer using nozzles (40), which are immersed in the stripping solution. This step could be considered the DI H2O cleaning step since it employs a DI H2O solution to strip (i.e.- clean) the photo resist layer off of the surface of the wafer. They further discuss limitations with the prior art in reference to the stripping of photo resist masks off of

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wafers with copper on their surface. This is discussed specifically in columns 1-6; and discussed in general in columns 1-10. This is shown in figures 1-6. Bergman et. al. fail, however, to specifically disclose the following aspects of applicant's claimed invention:

- the specific thickness, which are claimed by the applicant for their resist, etch mask;
- the specific usage of a spin/ dry process, which is conducted in either air or N2 to dry the wafer after the wafer has been wet cleaned;
- the usage of the specific wet cleaning (i.e.-wet stripping) process parameters, which are claimed by the applicant;
- the specific stripping of a photo resist etch mask on a Cu layer on a wafer; and
- the specific usage of a resist O2 ashing step prior to the wet stripping process which is used to remove the photo resist etch mask

It would have been obvious to one skilled in the art to employ a spin/dry process, which is conducted in N2, or in air after the wet cleaning process has been conducted in the process taught above based upon the following. The usage of a spin/dry process in an ambient of N2 or air to dry a wafer after it has been wet cleaned is conventional or at least well known in the semiconductor processing arts. (The examiner takes official notice in this regard.) Further, some type of means would have been desirable have been provided for drying the wafers after wet cleaning them.

It would have been obvious to one skilled in the art to employ the specific resist thickness which are claimed by the applicant in the process taught above based upon the following. It would have been desirable to provide a resist mask with an adequate

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thickness to conduct the etching process taught above without providing an excessively thick resist layer which would have wasted precious processing resources.

It would have been obvious to one skilled in the art to employ the wet cleaning process taught above to clean (i.e.-strip) a photo resist layer off of a Cu layer on a wafer based upon the following. Bergman et. al. discuss the problems with the prior art's removal of a photo resist etch mask from a Cu layer on a wafer in relationship to his invention. This suggests that his cleaning method provides a suitable means for cleaning this type of substrate while the prior art didn't.

It would have been obvious to one skilled in the art to employ a two step process to remove the photo resist mask in the process taught above which is comprised of first ashing the photo resist etch mask followed by second wet cleaning the photo resist residue left on the wafer from the ashing step based upon the following. It is conventional or at least well known in the semiconductor processing arts to use a two step cleaning process which is comprised of first ashing a photo resist etch mask followed by second wet cleaning the photo resist etch mask residue in an aqueous DI H₂O solution. (The examiner takes official notice in this regard.) Further, this would have simply provided an alternative, and at least equivalent means for cleaning the wafer in the process taught above to the specific means, which are taught above.

It would have been prima facie obvious to employ any of a variety of different process parameters in the cleaning process taught above including those which are specifically claimed by the applicant. These are all well-known variables in the cleaning art, which are known to effect both the rate and the quality of the cleaning process.

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Further, the selection of particular values for these variables would not necessitate any undo experimentation, which would have been indicative of unexpected results.

Alternatively, it would have been obvious to one skilled in the art to employ the specific process parameters which are claimed by the applicant in the cleaning process taught above based upon *In re Aller* as cited below.

"Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F. 2d 454, 105 USPQ 233, 235 (CCPA).

Further, all of the specific process parameters which are claimed by the applicant are results effective variables whose values are known to effect both the rate, and the quality of the cleaning process.

4. Claims 1-3, 9, 11-15, and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pyo (6,468,907).

Pyo disclose a process for forming a Cu dual damascene structure. They used a patterned photo resist etch mask during the etching of a via, and a trench in an ILD layer (13) which lies over a Cu wiring layer (12). They clean the Cu layer at the bottom of the trench in the ILD layer by spin rinsing the wafer in a cleaning solution. The wafer is rotated in the cleaning solution at a speed of (1-300) rpm. The wet cleaning solution may be comprised of pure D.I. H₂O as well as D.I. H₂O plus an acid such as HF or H₂SO₄. This is discussed specifically in columns 3-5; and discussed in general in columns 1-6. This is shown in figures 1A-1F. Pyo fails, however, to specifically disclose the following aspects of applicant's claimed invention:

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- the specific thickness, which are claimed by the applicant for their resist, etch mask;
- the specific usage of a spin/ dry process, which is conducted in either air or N2 to dry the wafer after the wafer has been wet cleaned;
- the specific usage of a O2 ashing step prior to the wet stripping process to remove the photo resist etch mask from the surface of the wafer; and
- the usage of the specific wet cleaning (i.e.-wet stripping) process parameters, which are claimed by the applicant

It would have been obvious to one skilled in the art to employ a spin/dry process, which is conducted in N2, or in air after the wet cleaning process has been conducted in the process taught above based upon the following. The usage of a spin/dry process in an ambient of N2 or air to dry a wafer after it has been wet cleaned is conventional or at least well known in the semiconductor processing arts. (The examiner takes official notice in this regard.) Further, some type of means would have been desirable have been provided for drying the wafers after wet cleaning them.

It would have been obvious to one skilled in the art to employ the specific resist thickness which are claimed by the applicant in the process taught above based upon the following. It would have been desirable to provide a resist mask with an adequate thickness to conduct the etching process taught above without providing an excessively thick resist layer which would have wasted precious processing resources.

It would have been obvious to one skilled in the art to employ a two step process to remove the photo resist mask in the process taught above which is comprised of first

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ashing the photo resist etch mask followed by second wet cleaning the photo resist residue left on the wafer from the ashing step based upon the following. It is conventional or at least well known in the semiconductor processing arts to use a two step cleaning process which is comprised of first ashing a photo resist etch mask followed by second wet cleaning the photo resist etch mask residue in an aqueous DI H₂O solution. (The examiner takes official notice in this regard.) Further, this would have simply provided an alternative, and at least equivalent means for cleaning the wafer in the process taught above to the specific means, which are taught above.

It would have been prima facie obvious to employ any of a variety of different process parameters in the cleaning process taught above including those which are specifically claimed by the applicant. These are all well-known variables in the cleaning art, which are known to effect both the rate and the quality of the cleaning process. Further, the selection of particular values for these variables would not necessitate any undo experimentation, which would have been indicative of unexpected results.

Alternatively, it would have been obvious to one skilled in the art to employ the specific process parameters, which are claimed by the applicant in the cleaning process taught above based upon *In re Aller* as cited above. Further, all of the specific process parameters which are claimed by the applicant are results effective variables whose values are known to effect both the rate, and the quality of the cleaning process.


5. Claims 4-8, 10, and 16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

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6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

7. Any inquiry concerning this communication should be directed to examiner

George A. Goudreau at telephone number (571)-272-1434.


George A. Goudreau
Primary Examiner
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